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ABSTRACT

The international exchange of technical information is discussed in relation to U.S. information policy since World War II. Facets of military needs and policies and the involvement of interested agencies (Department of State, Library of Congress, National Science Foundation, National Aeronautics and Space Administration, Atomic Energy Commission, Department of Health, Education, and Welfare, etc.) are described. The freedom of information concept is covered, as are the evolution of international cooperative information exchange and the technical information needs of developing nations. There are extensive references and a list of acronyms. (LS)

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INFORMATION FOR SCIENCE AND TECHNOLOGY: THE INTERNATIONAL SCENE

by
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INTRODUCTION

In this paper I propose to examine the bases of American national policies relating to the international exchange of scientific and technical information. This is a complex topic, even a diffuse one, and I have therefore decided to limit my inquiry chronologically, and to structure it arbitrarily.

I shall be concerned with the emergence of governmental policies during the period from the end of World War II to date, and I have divided consideration of this topic into three parts. The first part will be concerned with the bases of national policy underlying the acquisition and interchange of foreign scientific and technical information; the second will discuss the emergence of inter-governmental cooperation in information; and the third will examine the national efforts of the United States to transfer scientific and technical information to the less-developed countries, a function in which the library community historically has played a role.

By way of introduction, I should like briefly to describe why I have selected this topic for what were originally given as the 1972 Windsor Lectures' in Librarianship at the University of Illinois. First, the postwar period, 1945-70, has constituted the most explosive period of library and information science development in U.S. history. I should like to offer these reflections, admittedly incomplete and possibly biased, on our international role as a modest contribution to the historical record of librarianship. Second, I think

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it important for librarians and information scientists to know not only that governments, particularly that of the United States, have an increasing interest in scientific and technical communications, but why this is so. A fuller awareness will result in more effective participation. Third, I perceive present U.S. national policies to be in a state of flux. In many ways we have reached the end of an era, and we need to redefine our goals and to reorder our priorities. For a quarter of a century, unprecedented federal support of science against a background of Cold War competition has dominated the U.S. drive to develop scientific and technical information resources and systems. The high technology which has characterized these years reached its zenith with a man-made object about to escape the solar system. But even as this object was being launched, Congress was establishing an Office of Technology Assessment to advise it on the impacts of technology on the security and general welfare of the United States. Questions of man and his world, the quality of his natural and man-made environments, are now in the forefront of national and international policy consideration, and those of unrestrained technological development are receding into history.

Even as national science priorities are being reordered in reflection of these considerations, so national and international scientific and technical information policies are being re-examined. The new UNESCO program, UNISIST, has evoked thoughtful consideration of the nature, bases, and extent of U.S. governmental participation. Following its transfer from the White House to the National Science Foundation, the policy guidelines for the Committee on Scientific and Technical Information are being reviewed, and redirection may be anticipated. When one is considering which way to go next, it is helpful from time to time to look back in an effort to understand the available options. These retrospective studies constitute, therefore, a contribution to the cooperative effort, involving both government officials and professional leaders concerned with the further development of our international scientific and technical information policies.

Because of the initiatives and the accomplishments I shall be describing, the United States has achieved a unique position internationally. It is the world leader in the development of mechanized information systems for science and technology. The machine-readable data resources in the United States are unequaled by any other country. It is understandable that other countries are ambivalent in their relations with the United States. They admire, and they envy; they wish to take advantage of U.S. resources, yet they fear the imposition of American standards, of American computers, and of American systems technology.

The U.S.-built systems have outstripped ability to keep them fed; the U.S. is driven by economic pressure to internationalize them. Chemical Abstracts Service, Index Medicus, the International Nuclear Information System, the proposed Agricultural Research Information Service, all require international cooperation. There is clearly the beginning of a new era of international cooperation--one of operating systems--and one in which governments have clear interest. Lest our resources are dissipated and energies wasted, the United States clearly needs to understand its objectives. This alone should make inquiry in this area worthwhile.

INFORMATION FOR POSTWAR RESEARCH AND DEVELOPMENT

The year was 1946. An unprecedented scientific and technical effort had contributed to ending the war: radar, jet propulsion, proximity fuses, atomic energy. Conversion of the new technologies and redeployment of skilled manpower so that the peacetime economy and general welfare might benefit from wartime advance was the order of the day. At President Roosevelt's request, in Science, The Endless Frontier,[1] Vannevar Bush, the retiring head of the Office of Scientific Research and Development, had proposed an imaginative charter for the conversion of wartime research and development to a government-sponsored peacetime program of great magnitude. John Steelman, also at the President's request, in his report, Science and Public Policy,[2] had prepared an inventory of the massive resources available to government for its postwar scientific programs.

Traditionally, Europe had been the source of basic scientific knowledge to which the United States had turned in prewar years. An exhausted Europe could no longer be depended on to replenish the reserve of basic scientific knowledge so intensively exploited by wartime technology. Bush argued that the government should mount an unprecedented peacetime effort to foster scientific research and development, to train scientific manpower, to formulate national science policy, and to increase the flow of new scientific knowledge.

The reconstruction of a war-torn world was a priority postwar objective. The United States led in the establishment of the International Bank for Reconstruction and Development in 1945, and participated wholeheartedly in the work of the United Nations Relief and Rehabilitation Administration. In March 1947, as the political integrity of Greece and Turkey was challenged by communism, the Truman Doctrine of economic resistance was born. This led to the Marshall Plan of 1948, and to Point Four Plan of technical assistance to developing countries in 1949.

In another sector, even prior to the outbreak of Cold War, the race for technical intelligence of military applicability continued unabated. Agents in Operation Paperclip[3] ferreted out former Nazi scientists for expeditious transportation to military research establishments in the United States. The U.S.-U.S.S.R. rivalry in space started in Peenemunde.

Allied intelligence teams systematically assessed Nazi wartime technology, producing series of technical reports and encyclopedic reviews such as the FIAT Review of German Science.[4] The U.S. Air Force, with its monopoly on rapid trans-Atlantic transportation, flew forty tons of captured Nazi technical documents from Germany to the Wright-Patterson Air Force Base, where, under the imaginative and energetic leadership of Col. Albert A. Arnhym, a prototype mechanized documentation service, the Combined Air Documents Office, was established to organize their contents for air force exploitation.

Indeed, the flood of captured enemy technical reports reaching the United States was matched only by the mass of U.S. wartime technical reports, hitherto classified, but downgraded to be made available to American industry through the Office of the Publication Board--a program conceived and initiated by Vannevar Bush. As much as any one force, the confluence of these two streams created the urgency underlying the quest for information retrieval systems in the 1950s and 1960s.

In the field of library technology and cooperative programming, the immediate postwar years were particularly innovative. The Princeton Conference on International Cultural, Educational and Scientific Exchanges[5] in November 1946 provided guidelines for the postwar period. This conference approved twenty-four program recommendations for strengthening research library and bibliographic roles in international scholarly communication. The formal (and informal) agenda of the Princeton conference constituted heady stuff: discussions underlying the Farmington Plan, the Shaw-Bush highspeed selector, photoduplication and copyright, and program proposals for the new international agency, UNESCO, added to the intellectual ferment.

Indeed, the establishment of the new U.N. agency with its potential for library and bibliographic programs at the international level, served (in part) to focus the attention of the American library community on its international policy considerations. Ralph Shaw undertook a comprehensive study of the international activities of the ALA to be published along with a policy statement of the ALA International Relations Board the following year.[6] The ALA statement, emphasizing that it was "inconceivable that the A.L.A. should limit its activities to national issues and not seek means to promote international understanding,"[7] based its concept of postwar internationalism on four premises: (1) as the U.S. emerged from isolationism its citizens needed to be informed concerning the issues in international affairs; (2) libraries were essential to facilitate an adequate interpretation of the United States abroad; (3) librarians should support agencies (e.g. UNESCO) engaged in the promotion of international understanding; and (4) libraries were essential to the reconstruction of war-devastated countries.[7]

The seeds of U.S. national science policy (and consequently national science information policy) over the next twenty years are to be found in the events of 1946. A first national goal was the redirection of the enormous government-funded research and development effort of World War II to peacetime purposes on behalf of the public welfare, which then, as now, involved both economic and industrial development and social services.

A second major goal involved the continuation of wartime efforts to advance still more the sophisticated military-oriented technology which had won the war. A third consideration was that American science must in the future be self-sufficient. No longer could it or should it look to Europe as the source of all knowledge. A fourth consideration was the need to train scientific manpower, both as a means of assuring gainful employment to the returning veterans of World War II, and to insure the peacetime continuation of the wartime research and development effort. A fifth consideration was that of technological competition with the U.S.S.R., which had emerged from the war as one of the world's technologically advanced countries, and which developed in political opposition to the United States, thanks to Stalin's expansionist policies. Finally, it was found to be in the interest of the United States to share its technological knowledge with friendly war-torn nations, so that they in turn might achieve a level of economic stability which would permit them to resist communist infiltration.

These are some of the forces which have influenced the evolution of U.S. science policy since the end of World War II. I shall attempt to trace their

influences upon the evolution of U.S. national policies relating to scientific and technical information.

Science policy and science information policy are relatively new concepts. It would be worth a paragraph or two to discuss what science policy is, and how it is formulated. In 1945 Vannevar Bush wrote, "We have no national policy for science. The Government has only begun to utilize science in the nation's welfare. There is no body within the Covernment charged with formulating or executing a national science policy."[8]

Today, after nearly two decades of intensive cultivation of science for the nation's welfare, these words of Bush sound politically naive. The single research agency Bush hoped to create for this purpose, the National Science Foundation, became but one of many bodies engaged in formulating national science policy in the burgeoning bureaucracy. As its director, Leland Hayworth, told the House Committee on Science and Astronautics in 1966, "national science policy is a constellation of interrelated policies. These policies may be grouped together under this singular term because they affect, directly or indirectly, the level, substance, and conduct of scientific activities in the United States, the opportunities for, and content of education in the sciences, and the utilization and development of the nation's resources for science. Science policy is also shaped by state and local governments and by non-governmental institutions, enterprises and organizations. It is appropriate, therefore, to speak of a constellation of both public and private science policies."[9]

It is small wonder, with such variegated parentage of policy, that even its most mature formulators tend to cynicism. Alexander King, head of the Science Directorate of the Organization for Economic Cooperation and Development and, incidentally, a past president of the International Federation for Documentation, once quipped that science policy combines "the naivite of the natural scientist, the arrogance of the economist, the complacency of administrators and the ignorance of politicians."[10]

To quote a recent report prepared by the Legislative Reference Service of the Library of Congress for the House Committee on Foreign Affairs, "domestically, science policy has two distinct aspects: 1) the use of science and technology as an instrument to aid in the formulation and execution of public policy (called 'science in policy'), and 2) the formulation and execution of government policy to aid in the exploitation of publicly beneficial science and technology (called 'policy in science')."[11] This dichotomy has its parallel in our foreign relations; science and technology on the one hand may be considered as supportive of U.S. foreign policy, or, on the other, foreign policy may be used to support the growth of U.S. science and technology. For example, U.S. policy on the free interchange of science and technical information benefits domestic science and technology and, on the other hand, the export of technical knowhow to developing countries may be supportive of U.S. foreign policy, which is to strengthen those countries economically and politically. This part will concentrate on benefits to U.S. science and technology; the third part will concentrate on benefits to developing countries of free interchange of science and technical information.

I view science information policy as a specialized subset of science policy, subjected to the same influences, and reaching parallel conclusions. Some idea of the complexity of policy-making in the field of scientific and technical information may be had from noting the number of government programs involved in formulating and implementing policy internationally. In the executive branch of government, the Office of Science and Technology in the White House has been traditionally involved in the formulation of both domestic and international policy. It has done this directly and through one of its advisory groups, the President's Science Advisory Committee, as well as through another advisory group, COSATI of the Federal Council on Science and Technology.

Within the Department of State, there is the Office of International Scientific and Technical Affairs and the Office of International Organizations. One has a general concern for science internationally, including scientific communication, and the other is concerned with intergovernmental organizations with which the United States is associated. The Agency for International Development has a major influence on U.S. policy relating to scientific information for developing countries, as does the U.S. Information Agency.

The principle executive agencies operating science and scientific information programs with an international dimension both implement policy, and frequently formulate it on their own, individually as well as in concert. These include agencies such as National Science Foundation, the National Aeronautics and Space Administration, the Atomic Energy Commission, the Department of Health, Education and Welfare, and the Department of Agriculture. Many of these agencies maintain advisory committees to which they are careful to add representatives of the academic and industrial communities with whom they interact, and they frequently turn to these advisory groups for policy guidance. On the congressional side, to mention but two groups, the influence of the Senate Committee on Government Reorganization headed in the 1960s by Senator Hubert Humphrey, and of the House Committee on Science and Astronautics formerly headed by Congressman Emilio Daddario, on the formulation of science information policy, has been major.

The objectives of national science information policy have recently been stated by a high level advisory group to the OECD.[12] However various the inputs of the multiple American groups involved in making policy, it may be anticipated that they will be in agreement on the following four primary objectives the OECD group identified as national goals: (1) to insure the effective utilization of accumulated knowledge in science, technology, economics, and social science in order to achieve national objectives for the betterment of society; (2) to promote the development of science and technology; (3) to insure the availability of adequate information for decisions for management and for policy, both in government and in private enterprise; (4) to focus the attention of governments and private organizations on the problems of information availability and use.

International policy, both for science and for science information, is an extension of the domestic with, of course, the added complications already alluded to. The emergence of science and more recently of scientific information in the political armamentarium of the U.S. Department of State has been an outstanding phenomenon of recent years. As the Federal Council for Science and

Technology's International Committee reported in 1966: "Science possesses an objectivity which transcends differences in political and social systems--its language, its methods, and its ethics are universal. It can, therefore, be a powerful tool for building understanding among the peoples of the world and toward achieving eventual world cooperation."[13]

President Kennedy, speaking to NAS in 1963, stated that science had emerged from a peripheral concern of government to actual partnership. "I would suggest," he said, "that science is already moving to enlarge its influence in three general ways: in the interdisciplinary area, in the international area, and in the intercultural area. For science is the most powerful means we have for the unification of knowledge, and a main obligation of its future must be to deal with problems which cut across boundaries, whether boundaries between the sciences, boundaries between nations, or boundaries between man's scientific and his humane concerns."[14]

In addition, therefore, to the formulation of domestic information policies which will enhance its growth and development, the United States is concerned internationally with the utilization of scientific information resources and programs to enhance its foreign policy, be this in its relations to the industrialized countries, the U.S.S.R. and East European countries, or to the developing nations of the world.

Science policy and science information policy have always been closely linked. In 1949 the Secretary of State, concluding that the interaction of science and foreign policy would increase in the postwar years, called upon Lloyd B. Berkner to advise the department. To assist Berkner, the NAS established an advisory committee on International Science Policy. Berkner's report, which led to the establishment of a science advisor to the Secretary of State, as well as to the system of science attachés in American embassies around the world, is entitled Science and Foreign Relations: International Flow of Scientific and Technological Information.[15] Citing the statement of the Princeton conference of 1946, mentioned above,[5] the Berkner report stresses the responsibilities of the Department of State for fostering the interchange of science and technical information with foreign countries.

Reverting to my earlier statement that the roots of our national science information policy may be found in the events of the immediate postwar years, let us look at the evolution of policy relating to the acquisition of scientific and technical information from overseas to enhance the economic growth and development of the United States. Science, The Endless Frontier contained a report submitted by a committee on the publication of scientific information. This committee recommended the lifting of wartime restrictions on the circulation of technical reports prepared by the military and by the Office of Scientific Research and Development, and their wide dissemination to the benefit of American industry. As Ralph Shaw, advisor to the publication board created for this purpose by Executive Order 9568 of June 8, 1945, pointed out, it was hoped a source of jobs for all would be found "in the prodigious store of useful knowledge developed during the last five years under the stress of emergency conditions."[16] An international dimension was quickly added to the functions of the publications board by a second executive order which authorized the board to disseminate captured German technical documents.

This constituted the opening phase of governmental responsibility for the technical report announcement and dissemination functions handled successively by the publication board, the Office of Technical Services in the Department of Commerce, the Clearinghouse of Federal Scientific and Technical Information, and most recently by the National Technical Information Service.

It is in the field of cooperative library acquisition of foreign publications that there is found a principal legacy of World War II. Verner Clapp, with his usual historical consciousness, noted a parallel with World War I, when American librarians came to the conclusion the national library resources were neither adequate in themselves, nor had they been adequately mobilized to the demands made on them by the war.[17] This resulted during the 1920s and 1930s in the establishment of the regional bibliographic centers, regional union catalogs, and the National Union Catalog as well as the Union List of Serials, not to mention the enormous inventory of specialized library collections compiled during the depression years by the late E.C. Richardson, and the Historical Records Survey which introduced Luther Evans to the library world.

It should be noted that the Farmington Plan was conceived by Boyd of Princeton, McLeish of the Library of Congress and Metcalf of Harvard, and thus had, in part, a governmental origin. Indeed, the extent to which the Library of Congress assumed policy initiatives in the war and postwar years was exceptional. Boyd was lyrical over the leadership of the Library of Congress: "No other library in America," he wrote, "had such opportunities for inspired leadership in this critical moment and no other could have in like manner supported its vision with equal resources. Its insistence upon a declaration of policy by the government that the contents of the American libraries affect the national interest; its part in formulating the proposals for the consideration of UNESCO; its effectively planned and executed European mission; its distribution of several million texts and reference works to veterans; its initiation and implementation of the cooperative acquisitions project...these and many other extraordinary activities were projected in the interest of all American libraries."[18]

The circumstance triggering this statement was an exchange of correspondence between Luther Evans and Archibald MacLeish, Assistant Secretary of State and Evans's predecessor at LC. Evans proposed that during the postwar emergency period LC would use its official channels and its liaison with the Department of State to purchase materials on behalf of the private research libraries of the country. This proposal was made "because of the deep conviction based on daily experience, that the national interest, both in time of war and in time of peace, is intimately affected by the holdings of the large research libraries."[19]

This activity by the Library of Congress on behalf of the private large research libraries of the country was paralleled by a continuing emphasis on the need of the federal agencies to acquire scientific and technical publications in peacetime. Richard Humphrey of the Division of Research and Publication, Department of State wrote, "the government has been forced to the conclusion that its former procurement techniques were inadequate. This inadequacy was amply demonstrated by the dearth of vital foreign research materials at Washington's disposal at the outset of the war."[20] To remedy this situation, in 1945 the Department of State established a system of publications procurement officers which still exist today.

In addition, the Department of State proposed a coordinated federal acquisitions program on a government-wide basis.[21] An Interdepartmental Committee on the Acquisition of Library Materials would function: (1) to plan a comprehensive program of acquisitions among the several government departments and agencies; (2) to originate recommendations to the departments and agencies concerning

the development of their libraries within the framework of local or federal acquisitions; (3) to originate recommendations to the Department of State on policy relating to the procurement of foreign materials through the foreign service; and (4) to review requisitions on the State Department's procurement facilities whenever it became necessary to determine whether they were consistent with the comprehensive acquisitions program. The interdepartmental committee was formed, held several meetings, and then collapsed. Here, however, were the seeds of later developments which led to the cooperative acquisition and cataloging programs of the Library of Congress, on the one hand, and to the concerns of the Federal Library Committee with federal information resources, on the other.

The Interdepartmental Committee on the Acquisition of Library Materials, discussed by Humphrey, represents but one phase of the government's efforts to acquire scientific and technical information from overseas. During World War II, the Office of Naval Research in London had not only provided for scientific liaison with the United Kingdom, but had also developed a reporting system which comprehensively covered developments in European science.[22] The Bush[1] and the Steelman[2] reports both recommended that the Department of State establish scientific attachés in embassies around the world for the purpose of reporting on scientific advances overseas. The Berkner report[15] recommended the placement in embassies of science attachés who would have the duties of: (1) reporting on significant trends in foreign science; (2) collection and transmittal to the United States of foreign scientific and technical information; (3) promotion of the exchange of scientific personnel, information and materials; (4) advice to the mission on scientific matters; (5) representation and maintenance of the interests of the U.S. science and scientists abroad; and (6) cooperative research projects between the United States and foreign scientists. The science attaché system, established by the Department of State on the recommendations of Berkner, has proved to be eminently successful in representing the scientific interests of the United States overseas,[23] and in insuring a continuing flow of information concerning scientific and technical developments. As we shall see later, the science attachés have played a significant role in furthering the international sharing of American scientific and technical information systems.

It was determined to be the policy of the government in the immediate postwar years to maintain and to increase governmental participation in the acquisition of scientific and technical information from countries outside the United States. Jerrold Orne, writing in American Documentation, stated: "The Federal Government is today unquestionably the largest single acquisitioner of foreign technical literature of the world....The Federal Government is now openly committed to the principle of national responsibility for the acquisition of foreign information....It has now become abundantly clear to all that only through a carefully articulated, planned decentralization of resources and maximum bibliographic control is there any possibility of usefully absorbing all of the information available. It is equally evident that, while the responsibility must be decentralized, only the federal government commands the massive resources needed to provide the leadership complete availability requires. The evidence of the government's recognition of this responsibility has increased steadily in recent years."[24]

Political, economic and military competition with the U.S.S.R. provided the strongest of incentives during this postwar period. Said the Steelman report: "of particular importance in science is the work of Russia. The Soviet government is supporting a large group of universities and scientific research institutes from which many important results are being published. Much of this

material is being received in the United States but it is under-utilized because of the small number of our scientists who have a reading knowledge of Russian."[25] During the ten years which intervened between the Steelman report and the first Sputnik, the federal government supported a number of efforts to provide American scientists with information about the work of their Soviet colleagues. During the Stalin years, when the Soviets imposed export controls on their scientific and technical publications, the resources of government, including the publicatio procurement officers, helped to insure the regular receipt in the United States of Soviet technical publications. The Monthly Index of Russian Accessions was established in the Library of Congress as an effort to index and announce the contents of these publications. The NSF supported the efforts of the American Institute of Physics and the American Mathematical Society in the cover-to-cover translation of Soviet journals, and the National Institutes of Health started a similar program in the medical sciences. The Stalin period was matched in the United States by the McCarthy era, during the course of which shipments of Soviet scientific and technical journals were held up by the Customs Bureau in the port of New York until translators could get around to searching them for political propaganda.

All of this was changed by Sputnik. Walter Rostow writes:

> There is no clear analogy in American history to the crisis triggered by the launching of the Soviet earth satellite on October 4, 1957. This intrinsically harmless act of science and engineering was also, of course, both a demonstration of foreseeable Soviet capability to launch an ICBM and a powerful act of psychological warfare. It immediately set in motion forces in American political life which radically reversed the nation's ruling conception of its military problem, of the appropriate level of the budget, and of the role of science in its affairs. The reaction reached even deeper, opening a fundamental reconsideration not of only the organization of the Department of Defense, but also of the values and content of the American educational system and of the balance of values and objectives in contemporary American society as a whole.[26]

With some confusion of cause and effect, this Soviet technological triumph, as well as the Soviets' alleged advantage in a number of other scientific fields, was credited to the superiority of their technical information processing and dissemination system over that of the United States. The All Union Institute of Scientific and Technical Information (VINITI) was touted as a Soviet secret weapon in the race for technological advantage. Allen Kent and Jesse Shera brought to the attention of the Congress their proposals for an American counterpart to VINITI;[27] both Congress and the White House became very caught up in an urgent requirement to strengthen the American processing of scientific and technical information so that it might compete favorably with VINITI.

The year 1958 was second only to 1946 in the attention given by government agencies to scientific and technical information policy. One after the other, the House Committee on Government Operations, the House Committee on Science and Technology, the House Committee on Space and Astronautics and the Senate Committee on Government Reorganization summoned witnesses to hearings to discuss the question of what to do to remedy the deficiencies. The act investing NASA with an important new information function was passed. Title 9 of the National Defense Education Act, redefining and strengthening the Office of Science Information Service (NSF) and Public Law 480, Section 104k, permitting excess foreign currencies to be used for international scientific communication, were both passed during the year.

The President's Science Advisory Committee reviewed domestic science information policy in the light of the Soviet challenge. The PSAC report,[28] which has guided domestic policy from that time, declared that whereas the monolithic VINITI might be appropriate to the Soviet Union, such centralization was totally inappropriate to the United States which had an established information structure highly dependent on multiple professional initiatives and private enterprise. Instead, the NSF, as first among equals, should orchestrate the public and private information programs of the country.

Doubt arose over NSF's authority to orchestrate the programs of the federal agencies in view of their diverse statutory authorities, and eventually the coordinating function was taken over by the Committee on Scientific Information, later COSATI, of the Federal Council for Science and Technology.

Thus, while Sputnik contributed to a first-time formulation of a national science information policy, it also had its effect on U.S. international interests, activities and policies. The existence of nongovernmental organizations, such as FID, through which the United States specialists could meet with Soviet colleagues and discuss matters of mutual interest, took on a new significance. The United States and the U.S.S.R. agreed that FID should be revitalized and given important new responsibilities.

Personal contacts thus established, the way opened to exchanges of visits. The Soviets organized a strong delegation led by Oleg Mikhailov of the State Committee for Science and Technology of the Council of Ministers, U.S.S.R., which included A.I. Mikhailov, director of VINITI, to the International Conference on Scientific Information held in Washington, D.C., in October 1958. A return visit to VINITI was made by Dale Baker of the Chemical Abstracts Service and others interested in studying the Soviet system. Nikolai B. Arntiunov of the State Committee led another visiting delegation to Washington, D.C., in 1965, followed by the SLA-organized visit to the Soviet Union in 1966. These exchanges led to a far more realistic appraisal of the strengths and weaknesses of Soviet scientific and technical information activities, and indeed led to a significant level of cooperation between U.S. and U.S.S.R. professionals under the auspices of such organizations as FID, the ICSU Abstracting Board and CODATA.

There can be little doubt that the political reaction to the first Sputnik enormously accelerated the development of information technology in the United States. Within a few short years the country took giant strides

from a period of theoretical discussion and tinker-toy hardware, through the development of very large and sophisticated information retrieval systems, to the generation of large data bases which became unique in the world. The enormous technological superiority gained during this period has influenced to a very high degree the manner and amount of American international cooperation.

FREEDOM OF INFORMATION

The Berkner report[15] had recommended that the Department of State adopt a foreign policy that would permit the widest possible exchange of unclassified technical information and materials. Where military security contravened the free dissemination of information, the report further recommended that the Department of State use its membership on the government's Inter-Departmental Committee on Internal Security as a means of expediting the prompt resolution of situations in the field of foreign scientific relations in which arbitrary and unreasonable restrictions on the exchange of unclassified technical information existed.

This liberal attitude in general has been the policy of the United States government and remains so to the present. However, in 1954, the National Security Council became concerned about the volume of unclassified scientific, technical and industrial information which was being acquired by the Soviet Union. There followed an interesting and little-known interlude which serves to illustrate, if nothing else, the variety of inputs involved in the formulation of national policy.

It will be recalled that the Cold War was at its peak in 1954. The Soviets had restricted the export of their scientific and technical information, but were avidly acquiring large amounts of American material, including the newly issued nonclassified technical reports of some of the defense-related agencies. Not only did this appear to be an unacceptable balance of trade; it appeared to be adverse to the military security of the United States. The National Security Council requested the Department of Commerce to be responsible for the implementation of certain policy determinations governing the distribution of unclassified scientific, technical, industrial, and economic nonstatistical information. Through Department Order 157, effective November 1, 1954, the secretary of commerce established an Office of Strategic Information.[29] This office was assigned the job of coordinating the release of unclassified scientific, technical, industrial, and economic information, the indiscriminate distribution of which might be inimical to the defense interests of the United States.

According to Department Order 157, the Commerce Department was directed: (1) to establish an advisory committee composed of appropriate agencies for the purpose of furnishing guidance to and establishing policy for executive agencies on the publication of unclassified scientific, technical, industrial and economic (nonstatistical) information originating in departments and agencies of the Executive Branch, where such publications might be prejudicial to the defense interests of the United States; (2) to provide a central

clearinghouse to which business and industry might look for guidance in considering the public release of classified scientific, technical, industrial, or economic (nonstatistical) information where such publications might be prejudicial to the United States; (3) to establish an advisory committee to coordinate and establish the policies of agencies of the U.S. government in the exchange of publications with foreign countries and organizations; (4) to study the possibilities for pooling exchange operations for greater effectiveness in the national interest and security; and (5) to cooperate with and render advice to private organizations in connection with private international exchange of publications.

The acting director of the office addressed the American Chemical Society at the University of Minnesota (Minneapolis) on September 15, 1955. In his address he defined strategic information as "unclassified information which, if released or published, would be prejudicial to the defense interests of the United States, whether the information is prejudicial, all factors are weighed, both domestic and foreign, such as military, propaganda, economic, political, technological, and so forth."[30] Examples similar to the following were given: An aircraft manufacturing company received a $100,000,000 contract to build a certain aircraft, and the notice of this award was published by government. In the hands of a potential enemy this information would be prejudicial. Also, all aerial photographs contain strategic information in that they provide target information for the guidance of planes or missiles. It was the goal of the Office of Strategic Information to achieve a voluntary adherence by other federal agencies, by American industry, and by the press in withholding such information.

On the positive side, the office intervened with the Bureau of Customs and managed to have the latter's screening procedures streamlined so the contents of many hundreds of packing cases of Soviet scientific and technical journals stored in New York customs' warehouses might be distributed to their customers, including American research libraries.

Other than this, the office made little progress in coordinating the implementation of its program with the other federal agencies. Indeed, it came under heavy fire from the American daily press, which even then was occupied with its freedom to supply an unrestricted flow of information to the people from the federal government.

Representative Moss of California had been holding hearings on his Freedom of Information Act. On July 27, 1956, the Committee on Government Operations issued its twenty-fifth intermediate report on the availability of information from federal departments and agencies. The committee recommended categorically the abolition of the Office of Strategic Information in the Department of Commerce, stating that OSI witnesses had been unable to justify its existence either for the purpose of restricting the release of unclassified information from within the government or controling the distribution of unclassified information from outside the government.[31] A final blow was dealt to the office when President Eisenhower issued a statement declaring that it was the policy of the United States to exchange freely unclassified science and technical information with foreign countries, including the U.S.S.R.

It is interesting to note that U.S. policy today has become, if anything, more liberal. Secretary of State William Rogers, addressing the twelfth meeting of the Panel on Science and Technology of the House Committee on Science and Astronautics in 1971, stated today's version of this policy: "it is the general policy of this administration to permit the exchange of unclassified scientific and technical information with the scientists and institutions of any country, regardless of the state of our diplomatic relations with that country."32

It was this statement which inspired the press to ask if he had in mind the People's Republic of China. His affirmative answer noted the first thaw in relations between the United States and China.

I have already noted the problems experienced by the NSF, as one among equals, in coordinating the programs and policies of the federal agencies. On the other hand, in its own right, the NSF was extraordinarily effective in establishing healthy international relations with other countries, and in both developing and implementing U.S. policy relating to the international exchange of scientific and technical information. Additionally, each federal agency engaged in science, and hence in scientific and technical information programs, has a foreign relations program component. This is true of the Department of Agriculture, DOD, NASA, AEC, or HEW.

The international programs of LC are familiar to most librarians. Less familiar are the accomplishments of the federal executive agencies in establishing bilateral and multilateral agreements with their governmental and professional counterpart groups overseas. These cover a broad spectrum of activities, ranging from AEC's participation in the development of the International Nuclear Information System, to DOD's cooperation with AGARD, NASA's assistance to ESRO in the establishment of its RECON retrieval system, the National Library of Medicine's internationalization of the MEDLARS system, and many others.

When the Federal Advisory Committee on Scientific Information established by the Office of Science Information Service for coordination purposes was not successful, COSATI took over the function of attempting to coordinate the scientific and technical information programs of the federal executive agencies. For purposes of coordinating the international information activities of the federal agencies, and of recommending to its parent body, the Federal Council for Science and Technology, agreed-upon government policy, COASTI established a Panel on International Information Activities.

During its existence, this panel has inquired into such areas as the international exchange of scientific publications, the utilization of excess foreign currencies under Public Law 480 for scientific translation and related activities, the translation programs of the executive agencies, and the problem of the technology gap and possible contributions of federal information systems to its solution. A principal accomplishment of the COSATI panel has been the achievement of a federal agency policy on the international exchange of information, including information in machine-readable form.

Under the title, "Policies Governing the Foreign Dissemination of Technical Information by Agencies of the U.S. Government," this policy statement was issued in January 1968 with the approval of FCST.[33] The main objective of the policy was to insure the existence within the United States of at least one accessible copy of each significant foreign technical publication. To this end, international exchange of publications was to be encouraged. The policy encourages the dissemination of unclassified technical information, including that in machine-readable form, on a quid pro quo basis.

When positions were required for the official delegation attending the UNISIST Conference held by UNESCO in 1971, the COSATI international panel was asked to organize a public meeting for the purpose of exploring the reactions of the American information community in all of its aspects--industrial, academic, governmental, and individual.

In its efforts to recommend national science information policies, COSATI faces a formidable task. I have referred to the multiplicity of interests to be provided for in policy formulation. Donald Hornig, former Science Advisor to the President, made this point even better in a confrontation meeting organized by OECD on the national science policy of the United States. Hornig said: "There is no such thing in the United States as a science policy which can be isolated from the other policies of government. The problems of science are intimately related to our economic policies, to our policies concerning education, to our social policies, to our defense policies and to our foreign policies. And all of these together are part of the responsibilities of the President and the Congress."[34] The making of science information policy, which is, after all, a subset of national science policy, shares all of these complexities.

In addition, U.S. national priorities are in a state of rapid evolution. The Cold War and the all-consuming drive for new knowledge with which to feed research and development and high technology have lost their magical power to goad the country to ever-increasing technological advances. Technology assessment, not unbridled expansion, is the order of the day. The containment of world population may now have higher priority than the containment of world communism. The issues of urbanization, the environment, and the quality of life, both domestic and international, are supplanting the space race with the U.S.S.R. as national priorities.

Not to be overlooked as U.S. policies are reassessed is a growing attitude that liberal attitudes toward the dissemination of technical information may have worked to the economic disadvantage of the United States. The freedom with which technical information is circulated domestically has been noted by Europeans as a factor in U.S. technological leadership. On the other hand, the ability of some of the U.S. economic competitors--Japan and the Federal Republic of Germany--to gain advantage at our expense is a cause for growing concern.

The consequences of this shift in national goals can be seen but imperfectly; however, it is sure to have an impact on science information policies. As the United States engages in intergovernmental efforts, such as those supported by the OECD, by the FAO, by the AEC, and in the UNISIST program, what

should national objectives be? What is it the United States should wish to accomplish by such participation? Will the participation return benefits? How can it enhance the U.S. contribution to a productive, peaceful world?

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NEW DIMENSIONS OF INTERNATIONAL COOPERATION

In introducing the "three Cs" report, Cooperation, Convertibility, and Compatibility Among Information Systems: A Literature Review,[1] the authors point out that two developments since World War II converged to bring about greater coordination in the handling of scientific and technical information. These were: (1) the large-scale involvement of the government, both in sponsoring and in supporting research and development efforts, with the accompanying recognition of its responsibility to make public as promptly and as widely as possible the results of such efforts; and (2) the technological advances which have occurred in information processing, with its great potentialities for radically new systems and techniques.

This chapter is devoted to an exploration of the impact of these two forces--governmental interest and technological advance--on the character of international cooperation in the scientific and technical information field.

Some cynics apply a theory of "problem induction" to society's struggles with the information problem. According to this theory, the problem is never solved; groups wrestling with it at a lowly operating level induce a current in a group with a higher level of authority, which in turn struggles with it and induces a current at a still higher echelon. Thus the library problem has been escalated to the attention of a national commission; the scientific and technical information problem was escalated to the level of Congress, the President's Science Advisory Committee, and the Federal Council for Science and Technology.

Regardless of the degree of truth in this theory, the fact is that over the past twenty-five years problems associated with the provision of information for science and technological development have been escalated to the attention of governments, both domestic and foreign. In the United States, this concern is clearly expressed in the Weinberg report:

> Since strong science and technology is a national necessity, and adequate communication is a prerequisite for strong science and technology, the health of the technical communication system must be a concern of Government. Moreover, since the internal agency information systems overlap with the non-Government systems, the Government must pay attention to the latter as well as to the former.
>
> The Government must be concerned with our non-Government communication systems for another, less obvious reason. The technical literature with its long tradition of self-criticism helps, by its very existence, to maintain the standards, and hence the validity, of science, particularly of basic science. The Government, as the largest supporter of basic science, has a strong interest in keeping viable this mechanism of critical review of the science it supports.[2]

At the international level, the governmental responsibilities have been well stated by Judge, "Firstly, no single group of information producers, processors or users could possibly assume responsibility for the whole picture....Only government can encompass the total range of these concerns, objectively and with the resources to back up its interest. Secondly, the point is clearly made in many of these issues...that government should provide the leadership functions, acting as co-ordinator, promoter, catalyst but not necessarily as the operator of information systems....Government has inevitably to assume the major overall responsibility here for the wise management of the nation's 'most important resource.'"[3]

Both domestically and internationally, the processing and provision of scientific and technical information in support of national research and development goals has come to the attention of national governments. Since governments create special climates and mechanisms for intergovernmental cooperation, the character of cooperative agreements into which they enter differs markedly from that of cooperative agreements established by non-governmental voluntary associations and organizations.

A second consideration also affects markedly the nature of intergovernmental cooperative undertakings, namely the technological advances referred to by the authors of the "three Cs" report. The rapidity with which the new information processing technology has evolved in recent years has created numerous new opportunities to solve problems cooperatively, instead of individually. Opportunities for cooperative effort at the systems level have multiplied many times. The days when international cooperation meant international interlibrary loans, the exchange of abstracts or cataloging copy, or the division of extensive bibliographic undertakings into national segments have to a considerable extent been displaced by the sharing of computer software, the operation of on-line retrieval systems, and the development of international communications networks.

Further, because this type of cooperation at high technological levels is expensive, new economic incentive for international cooperative agreements has arisen, and finally, because the technology is new, in many cases vested economic interests in the maintenance of the status quo have yet to be established. The situation is still sufficiently fluid to invite new efforts at international standardization on which cooperative work-sharing agreements may be based.

The United States has a particular interest in exploring new approaches to cooperation. During the years 1945-65, the United States acquired a position of world leadership in the development and operation of sophisticated information retrieval systems. During the immediate postwar and post-Sputnik years, the foundations of the new information technology were laid. The International Conference on Scientific Information of 1958 demonstrated the vigor and the maturity of American information technology, and may be taken as a turning point in its historical development. No other nation after that date could match the resources and incentives fueling the American effort during these formative years.

By 1965, the United States had lived through the era of systems development and was entering an operational era. As a consequence, the view of international cooperation held by the Americans was based on different premises than that of the Europeans and others. The American interest was that of controlling operating costs through sharing the expense of inputs. Having created giant information systems, the Americans were faced with the need to maintain them at the level they had been designed for, and they pursued possibilities of cooperation with countries which could help them.

For a number of reasons, therefore, traditional patterns of voluntary professional cooperation are inadequate for present-day practice. The problems of applying technical information to national economic development have brought the activities involved in information handling to the attention of government leaders; the costs of processing information have increased almost beyond the ability of private means to meet them without governmental subvention; and the increasing sophistication of information storage and retrieval systems requires more formality in cooperative agreements. Such cooperation tends to require the sanction and support of governments.

Alexander King, an elder statesman in the international information field and Head of the Science Directorate of the Organization for Economic Cooperation and Development, and a past president of FID, spoke to ASLIB a few years ago. His words seem to be a particularly useful corrective to romantic thinking about international cooperation!

> On looking closely at international activity and especially at that of the smaller international bodies, a number of inherent shortcomings become apparent. Many of the international organizations for specific subjects have grown up from the initial contact of a few enthusiastic individuals from different countries who worked together, as a labour of love, for many years. This initial phase

> in international co-operation is, I think, the happiest and it may even be the most useful stage in the growth of a body. It leads to the establishment of close and fruitful friendships between a few individuals with the same enthusiasms in different countries. With the natural growth of such bodies in fields where there is a need for them, a time is reached when the amateur approach to international organization is no longer is no longer possible: when a really efficient, and consequently expensive, secretariat is required, when papers have to be turned out quickly and efficiently and contacts established all over the world with the right bodies. It becomes impossible for a small body of amateurs to carry on at all and many international bodies have become wrecked at just this phase. There is a second danger which has to be guarded against: international activities attract the interests not only of the amateur and the enthusiast, but of the fanatic. As a consequence, many international bodies are somewhat suspect by serious workers in a particular field because those in command appear to lack all perspective and to be riding their hobby-horse with greater vigour on the broad but distant international field than is tolerated in the home paddock....Another fault in some international bodies is that co-operation has become an end in itself while the reason for the co-operation is forgotten. Numbers of problems are tackled which are not inherently suitable for international discussion and which could be tackled much more usefully in the various separate countries.[4]

I shall be examining below in some detail the accomplishments of the intergovernmental agency, OECD, with which King has been associated. First, however, a brief conspectus of the world of intergovernmental organizations will provide appropriate orientation.

Intergovernmental organizations are to be distinguished from international nongovernmental organizations; they frequently derive their authorities from international treaties and conventions; participation in their activities is limited to governments acting through their foreign offices and their specialized agencies, with appropriate observance of governmental protocol and formalized communications. While a number of nongovernmental international organizations have "national members" which maintain liaison with their national governments, domestically (FID being a case in point) such NGOs are not constituted as agencies created by governments for the discussion of communal problems.

Intergovernmental organizations are two types: global and regional. The United Nations and its specialized agencies--UNESCO, FAO, the World Health Organization, the United Nations Industrial Development Organization--represent intergovernmental agencies, global in their scope. Regional intergovernmental organizations are usually organizations of neighboring states, with common geopolitical or economic characteristics and program interests. They may be of a general or a specialized nature. The Organization of American

States, the Commission of the European Communities, and the Council for Mutual Economic Assistance of the eastern democracies, are examples of regional intergovernmental organizations with generalized interests in economic development. While initially organized on a regional basis to foster European postwar recovery, the OECD has since acquired global characteristics by admitting the United States, Canada, and Japan to membership. The Regional Economic Commissions of the United Nations (e.g., Africa, Latin America, Asia and the Far East), demonstrate the UN's accommodation as a global intergovernmental organization to the common regional interests of groups of its member states.

Whether global or regional, virtually every one of these intergovernmental organizations in recent years has formed committees or working groups, or sponsored surveys and studies for the purpose of advancing the interests of their member states in the provision of scientific and technical information services.

The library development programs of the OAS are well known. Less familiar, perhaps, is an ambitious new pilot project, part of a program on the transfer of technology under development through the Regional Program for Scientific and Technological Development of the OAS. The provision of technical information supportive of technology transfer plays an important role in this new OAS undertaking.[5]

In October 1967, the Council of the European Community Countries asked its Committee for Medium-Term Economic Policy to "examine the ways and means of setting up a Community system to process and disseminate technical information or of coordinating the national data systems." Studies were undertaken on the feasibility of programs to be undertaken by the community in biomedical and agricultural documentation, and the EEC council of ministers approved the establishment of a European data network on the subject of metallurgy, in collaboration with the specialized documentation centers of the member countries in June 1971. Their resolution also called for coordinating action by member states in the field of scientific and technical information, and for the gradual establishment of a European information and documentation network. A System of Documentation and Information for Metallurgy for the European communities is under development.[6]

The CMEA, the Eastern European analog to OECD, similarly has concerned itself with the coordination of technical information programs and functions of its member states. In 1969 it established an International Scientific and Technical Information Center in Moscow, charging it with the function of strengthening the cooperation among the national scientific and technical documentation centers of its member states.[7] The center has as its objectives the creation of an international scientific and technical information system by the cooperating national systems, the establishment of international sectoral subsystems, and methodological standardization among the national systems to enhance interaction and cooperation.

These are representative of new program undertakings by regional intergovernmental organizations; many more may be cited. While it is difficult to select from among the information programs of intergovernmental organizations for special attention, two may be singled out for special attention: OECD and UNESCO.

From its earliest days, OECD has been concerned with technical information resources as a function of economic development. The Organization for European Economic Cooperation, its predecessor, had dispatched a postwar mission to the United States in an effort to review American technical developments in the information processing field. The OECD Committee on Scientific Research maintained for years a scientific information liaison officer.

In 1965, the United States proposed the establishment of an ad hoc group on National Scientific and Technological Information Policies which would develop the organization's concerns for scientific and technical information from the level of documentation to that of national research and development policy. The U.S. proposal pointed out that: "national governments have an unique opportunity, as well as a major responsibility, to shape the scientific and technological information activities broadly, as national systems comprising many interdependent parts. Within a government, communication of scientific and technological information, cuts across lines of executive responsibility and traditional boundaries berween disciplines and agency missions. Further, the communication problems of government are inextricably intertwined with those outside the government. Both the governmental and the non-governmental communities are concerned with the same total body of information and the progress made in each contributes finally to the other."[8]

This new OECD initiative led to a number of interesting results. A continuing Information Policy Group has been both active and influential. It raised questions of information policy as related to national development policy to the third Ministerial Conference on Science, held in March 1968. The ministers recommended that the member countries of OECD "take the appropriate steps to establish, within their government, a single, high-level 'focus,' to be responsible for all the countries activities concerning scientific and technical information."[9] The IPG initiated a series of national "confrontations" whereby member states, for purposes of criticism and guidance, would formally brief other members of the IPG on their information resources, policies and plans.

A crowning achievement of the OECD's IPG is the preparation through a subcommittee and subsequent publication of the report, Information for a Changing Society. This report is broadly concerned with the needs of governments for information as a basis for the decisions they must make between the benefits of technological innovation, and the dangers of imprudent choices as concerned with the totality of information requirements, economic, social, as well as scientific and technical, for this technology assessment.

Noting that reliance by any one country on self-sufficiency of information resources has never been a realistic policy, the report calls on OECD to use its offices to promote bilateral and multilateral cooperative agreements among its member states. It specifically calls for an increase of cooperative activities: "International cooperation as a means for using the store of human knowledge more effectively should be increasingly relied upon and strengthened, and nations should design their research and development policies to take account of world knowledge as available through proper investments in information transfer systems."[10]

Of particular importance was the role the IPG played in forwarding the internationalization of the American mechanized retrieval systems in medicine and chemistry. The establishment of the IPG was contemporary with the publication of Servan-Schreiber's influential book, The American Challenge.[11] This work introduced the concept of a "technology gap" existing between the United States and European countries, requiring vigorous efforts to redress. The book had a considerable impact. The Italian Foreign Minister Fanfani addressed a request to the American government requesting assistance from the United States in closing this "technology gap." Governmental encouragement of the internationalization of MEDLARS and the Chemical Abstracts Service was part of the U.S. response. OECD established working groups in biomedical information and chemical information to explore desirable modes of establishing the two mechanized systems and services on the European continent.

In the case of MEDLARS, two circumstances conjoined to complicate negotiations through OECD:[12] (1) the general preference of the Department of State for multilateral international agreements as opposed to bilateral, and (2) the limitations on the resources of the National Library of Medicine. During the developmental period of MEDLARS, overseas research centers for MEDLARS had already been established in Sweden and the United Kingdom, and NLM could support but one additional European search center.

Efforts to achieve a consortium of European countries through OECD to finance and operate this one additional center were not successful. However, the ultimate result was a progressive program for the internationalization of MEDLARS through a series of bilateral agreements, a first with the Institut National de la Santé et Récherche Médical in Paris, and a second with the Deutscher Institut fur Medizinsche Dokumentation und Information in Germany. NLM has subsequently assisted Japan and Austria in the establishment of MEDLARS centers and, with the replacement of the original MEDLARS by the on-line MEDLINE system, is sharing this new capability with its international affiliates.

In the case of chemistry, the Chemical Abstracts Service had been conducting discussions with the Chemical Society (United Kingdom) and the Gesellschaft Deutsche Chemiker, sponsors of the Chemisches Zentralblatt, for a number of years, relating to their common professional interests in effective and comprehensive abstracting of the literature of the chemical sciences. The OECD's IPG expressed the interest of member countries in accessing the data bases under development by CAS. In response, CAS proposed to an OECD Panel on Specialized Information Systems in Chemistry a plan through which it would share its tape products with interested countries in return for input services. This offer served to catalyze action in two countries. The British formed a consortium of chemical information interests, the United Kingdom Chemical Information Services, and the Germans, with strong support from the German chemical industry, authorized their chemical society to suspend the Zentralblatt, and to enter into cooperation with CAS.

CAS proceeded to achieve bilateral agreements with its opposites. The Germans undertook to supply CAS with English-language abstracts of papers and patents published in Germany. In time, it is expected that they will provide index entries in machine-readable form as well. The British elected to

concentrate on problems of preparing index entries, with the expectation that they will be providing machine-readable abstracts and index information from all chemical journals published in the United Kingdom.

As more partners are found, there may well be half a dozen countries inputting chemical information into the systems managed by CAS, with each in turn sharing the benefits of searching the cooperatively produced files.[13]

One or two comments might be made about this new form of cooperation. First, it represents a sharing with other countries of a data base developed by the United States in return for a product or service which, more often than not, is in the form of input to the system. Thus, the agreement is compatible with the published COSATI policy[14] in the international availability of machine-readable information. Second, the fact that both parties are concerned with the maintenance and operation of a system with its own highly specific and inexorable demands not only lends incentive to the continuing cooperation, but necessitates a formal cooperative agreement, with standardized practices, work quotas, provision for formal training, update seminars and the like. The system, in short, enforces a disciplined cooperation of a new type. An example of the internationalization of a U.S. developed system independent of OECD's mediation is that of NASA's RECON or remote console system. Following its experimental establishment in 1969, NASA first expanded RECON to provide all NASA centers with an on-line capability of searching technical report information, and then offered the system to the European Space Research Organization for establishment on the European continent. With central processing facilities in Darmstadt, and console query stations in Paris, London, Amsterdam and Stockholm, RECON became the first on-line information retrieval system to transcend national frontiers.[15]

Through its Road Research Program, OECD serves as the Secretariat for a sixteen-country International Road Research Documentation network. Each unit of the network has its own data base, and adds selections from that of the others; compatibility permitting this interchange has been carefully developed. There are three coordinating units: the Transport and Road Research Laboratory in the United Kingdom, the Laboratoire Centrale des Ponts et Chausees in France, and the Bundesanstalt fur Strassenwesen in Germany. Through its association with the network, the International Road Federation supplies reports of research in progress from thirty countries, while through its affiliate, the Highway Research Board of the National Academy of Sciences, it makes its data base available.[16]

The international activities of members of the Information Industry Association constitute an approach not too dissimilar from that of some of the Government agencies. Both make a data base available, with training in its use, in return for a consideration. I distinguish here between sales to a single organization or company within a country, and transactions at the national level where U.S. industry assists an agency of a foreign government in establishing national services in that country.

Thus the Institute for Scientific Information sells its tape products to the National Science Library in Canada, where they constitute one of the

basis for the nationwide selective dissemination of information services provided by the Library. Similarly, ISI sells its tapes to the Royal Institute of Technology in Stockholm, where, together with the tape products of other systems, they serve a similar purpose.[17]

The export of total systems for use on a national scale, including the establishment and training of systems operators, goes beyond the sale of tape products to an operating center. Thus, ISI has assigned the national franchise for the Automatic Subject Citation Alert system, a tape-based alerting service, to the Kinokunya Book Company in Japan. It has aided the Department of Libraries and Archives of the Ministry of Education in Spain in the establishment of a search capability for ASCA tapes and has a contract with the Consejo Nacional de Ciencias y Technologia in Venezuela for the same purpose.

While MEDLARS, CAS and others are concerned with the international sharing of a U.S.-developed data base in return for input, others are approaching the same goal through the creation of a cooperatively designed and operated international information system. The EURATOM system designed and developed cooperatively by the Common Market countries adhering to the European atomic energy community is a prototype. Rather than to develop its own large computer-based retrieval system, the AEC in the United States took the approach of encouraging the International Atomic Energy Agency, a specialized agency of the United Nations located in Vienna, to support the international cooperative development of an International Nuclear Information System which would have both decentralized inputs and decentralized outputs. INIS is just now becoming operational.[18]

There are obvious political advantages to this form of cooperation. A number of countries are apprehensive about the technological lead of the United States in systems development, not to mention their dependency upon an alien data base, and feel that this form of cooperation, in which they, along with others, can place their own national imprint upon the growth of a system, is the only true form of international cooperation. The creation of international systems, whether designed and built cooperatively or maintained cooperatively, is still in its infancy, and we need considerably more experience before we can pass judgment on the preferred routes.

At the present time, the National Agricultural Library is engaged with representatives of other countries under the sponsorship of the UN's FAO in the cooperative planning and design of an Agricultural Research Information Service.[19] AGRIS is a very sophisticated approach on two levels--level one is a comprehensive index to the world's literature, and level two is a network of specialized information and analysis centers with responsibility for in-depth indexing and evaluation within particular subject areas. This will indeed be a most interesting development which is bound to contribute to an understanding of cooperative systems building.

Since this form of international cooperation is relatively new, and so far has directly affected a limited number of people, it is appropriate to share the experience gained. I note below some conclusions from personal experience, and that of my colleagues:

1. Negotiations at the governmental level customarily lead to some form of agreement or contract, wherein the obligations of the countries to each other, the resources they are willing to commit, any limitations, the use of the products, and the understandings on the sharing of costs are all formally documented. It is necessary to state the precise objective of the cooperation and how much it is going to cost in order to gain the necessary approvals.
2. Ability either to develop a system cooperatively, or to engage in its cooperative functioning requires formal agreement on its conventions. This is another way of saying that all concerned must agree on a variety of standardized practices in order to insure the integrity of the system and its ability to perform.
3. Cooperation in the operation of a system requires formal training. When this training is international, it may be expensive.
4. Systems are always in a state of evolution, which places a heavy burden on their documentation and mechanisms for internal communication. Updating seminars, involving international travel, are also expensive.

Despite these caveats, it is inevitable that there will be a greatly increased level of international cooperation in the maintenance and operation of retrieval systems in the future. Indeed, this is an economic imperative; the costs of these large systems must be shared in order for them to survive.

This thought brings one to a consideration of UNISIST--the new program which UNESCO intends to operate to bring about a higher level of cooperation among and between the information services of the world, whether privately or governmentally sponsored. The latest, and perhaps the most comprehensive of international efforts to improve communication among the world's scientists is UNISIST, currently being launched by UNESCO. UNISIST is a program which has as its objective the improvement of the international flow of scientific and technical information through raising the level of voluntary cooperation between governments and international scientific and professional organizations.

Its origins in UNESCO go back to the organization's early acceptance of responsibility for encouragement of bibliographic activities. One of UNESCO's early objectives was the elimination of duplicative effort in scientific abstracting. In 1949, for example, it held conferences on the Coordination of Medical and Biological Services, to which Jesse Shera and Margaret Egan contributed "the United States Report on National and International Bibliographic Problems."[20] From these early times, UNESCO has assumed a dual role of encouraging member states to produce national comprehensive bibliographies, while at the same time fostering international bibliographic efforts in subject sectors such as science and technology. The former efforts have been lodged in the UNESCO Department of Documentation, Libraries, and Archives, and the latter in the Division of Scientific Documentation and Information in the Science Sector.

In 1963, Pérez-Vitoria of the UNESCO Department of Natural Sciences undertook an expanded program in the area of science documentation.[21] As a function of program development, three working parties were convened: the first, meeting in Philadelphia in September 1963, discussed problems relating

to scientific publication; a second meeting in Moscow in November 1963 discussed automated storage and retrieval; and a third meeting in Rome in January 1964 examined problems raised by scientific translation and terminology. These were preliminary, in UNESCO's thinking, to the holding of an international conference on scientific and technical documentation in the late 1960s.

Concurrently, at a Pugwash Conference in 1964, Bentley Glass of the United States expressed concern that in its race for automated information processing systems, the lack of coordinated effort in the scientific world would lead to a contemporary Tower of Babel and nullify the traditional responsibilities of the sciences for maintaining international information flow. The International Council for Scientific Unions took up the challenge, and invited UNESCO to join it in an effort to study the problem.[22] A joint study of the "Feasibility of a World Science Information System," later called UNISIST, was started in 1967. This study culminated in a report which concluded that an increased level of cooperation toward the establishment of such a system was both feasible and desirable.[23] To the disappointment of some, the report did not delineate the organization and characteristics of such a world system, but instead recommended the establishment of a program within UNESCO to stimulate and catalyze intergovernmental and international cooperation.

There were twenty-two recommendations of the UNISIST report, organized under the following five program objectives:

1. the development of tools to facilitate the interconnection of existing and future systems;
2. the strengthening of institutional components (e.g., libraries, abstracting and indexing services, translation centers, information analysis centers, etc.);
3. the cultivation of manpower resources for systems operations;
4. the involvement of governments in establishing national policy, national development centers, and international service networks; and
5. correcting the imbalance between information services in the developed and the developing countries.

These recommendations were referred to an Intergovernmental Conference, convened by UNESCO in October 1971, and, following approval by the conference, programming for their implementation was incorporated in the UNESCO program plans and budget for 1973/74.

As mentioned earlier, the UNESCO role was defined as catalytic rather than operational. With its limited resources, UNESCO plans to implement the study committee recommendations through a series of modestly funded projects which will facilitate cooperation between and among individual governments and nongovernmental organizations, and will provide them with guidance and counsel. Thus, in order to improve the connectibility of information services and systems during the next biennium, UNESCO will sponsor such activities as: (1) a world inventory of information referral services in science and technology, to be organized jointly by FID and the (U.S.) National Federation of Science Abstracting and Indexing Services; (2) a project to accelerate the standardization of bibliographic elements of machine and manual informa-

tion systems, in association with the manual of practice developed by the ICSU/Abstracting Board Working Group on Bibliographic Descriptions; and (3) the establishment of an International Serials Data System, to incorporate the assignments of international standard serial numbers for the establishment of an international information center for scientific terminology.

By recommendation of the UNISIST Intergovernmental Conference, the governance of UNISIST will consist of a steering committee of eighteen members, nominated by the UNESCO General Assembly, and a scientific advisory committee, named by the UNESCO director general.

Since UNESCO is an intergovernmental agency, and UNISIST an intergovernmental program, the Department of State is responsible for organizing U.S. representation on the UNISIST steering committee, as well as interpreting U.S. interests in the conduct of the UNISIST program. The State Department has requested the assistance of the NSF in serving as a national focal point to represent the diverse interests of the U.S. communities--academic, governmental, and industrial--concerned in UNISIST, as well as in the formulation of national positions on issues and priorities associated with UNISIST program development.

UNISIST has been launched successfully as a new UNESCO program. The field of scientific and technical information is both politically and technically complex. There are widely diverse politico-economic backgrounds and attitudes represented among UNESCO's 125 member states. These range from the centralized state enterprise of the socialist countries, to the highly decentralized and even competitive balance of not-for-profit and for-profit, and the public and private interests in the western democracies. They range also from the sophistication, high technology, and massive resources of the heavily industrialized countries, on the one hand, to the institutional and resource deficits of the smallest of the emerging nations on the other. The eighteen-man steering committee will necessarily represent the diversity of views and interests represented by this spread. The challenge which UNESCO faces, as it has faced so often in the past, is that of finding common denominators of international concern sufficiently urgent enough to appeal to the domestic concerns of its member states, and to enlist their support and cooperation. Whatever else may be said of the UNISIST program, it can be stated confidentially that it presents countless new opportunities for the future intergovernmental cooperation to the end that the international flow of scientific and technical information to and from all countries be materially advanced.

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INFORMATION TRANSFER TO DEVELOPING COUNTRIES

The first part of this paper was concerned with the subject of information inputs necessary for the fueling of an accelerated peacetime research and development program in the United States. The second part was concerned with the ways and means through which the United States is cultivating the cooperative processing of information generated throughout the world. This part of the paper is concerned with information outputs. How and with what success has the scientific and technical information the United States has generated and acquired been disseminated to the benefit of the world community of nations, particularly to those less fortunate?

This topic, like others in this paper, has its origins in World War II, which devastated large portions of the world as it had been known, and imposed a political, economic, and moral obligation on the surviving nations to assist in its reconstruction. One of the earliest statements of this economic imperative was included in the Steelman report of 1947. In this report, Science and Public Policy, the President's Scientific Research Board stated: "It is equally important to our interest, as part of the plans for reconstruction of the devastated countries of Europe and Asia, for us to lend every possible aid to the re-establishment of productive conditions of scientific research and development in all those countries willing to enter whole-heartedly into cooperation with us."[1]

The U.S. national response to the challenge of foreign aid in the immediate postwar years took two forms: (1) a program of humanitarian assistance which was accomplished through strong support of the U.N. Relief and Rehabilitation Agency, and (2) support for economic rehabilitation designed to strengthen the democracies of the free world against infiltration by world communism.

The organized efforts of the library community both during World War II and in the immediate postwar years were, however, more oriented toward the revival of scholarship on the European continent than they were to technical assistance. The contributions of the American library profession to rehabilitation were reviewed by Paul Bixler in Library Trends,[2] and I do not intend to repeat them here, other than to mention a few highlights which serve to illustrate the making of national policy.

Reflecting postwar internationalism, the ALA International Relations Board in 1946 commissioned Ralph R. Shaw to review the international activities of the association.[3] In doing so, Shaw made a series of organization recommendations. Significantly, he pointed out that there was no conflict between governmental and nongovernmental interests in the library community's international relations work, and that government agencies needed the services of the nongovernmental library association, just as the association needed the support of government in this field. The ALA International Relations Board, deeming it "inconceivable that the American Library Association should limit its activities in the future to national issues and not seek means to promote international understanding," affirmed in its policy statement that: "I. Librarians should seek ways to promote the use of and to make available all materials which will inform the citizens of the United States concerning the issues involved in international affairs...II. Librarians should lend their special abilities and services to facilitate an adequate interpretation abroad of the United States...III. The American Library Association should...[place its capabilities] at the disposal of agencies [such as the newly founded UNESCO]...engaged in the promotion of international understanding...IV. The American Library Association should foster and develop plans for the exchange of librarians between this and other countries...V. The American Library Association should...assure the continuation and expansion of the exchange of information and ideas between this country and all other countries."[4]

In this same year, 1946, the Princeton Conference on International Cultural, Educational, and Scientific Exchanges affirmed the principle that "society's progress depends upon the extent to which scholars and scientists of the world have free access to all sources of information and research."[5] One of its recommendations proposed that the American Book Center be further developed for the transmission of American informational materials to libraries in foreign countries, with priorities for materials to those countries that have suffered most from the war.

These early statements of policy by private, professional interests reflect the hopes of all at the end of the war that American isolationism was at an end, and that the fresh start at international understanding through a new agency, UNESCO, would augur well for the future.

Even as the reconstruction and rehabilitation programs of the United Nations were launched, Stalin moved to consolidate not only Eastern European countries which had come under Soviet liberation and domination, but also two countries peripheral to Central Europe--Greece and Turkey. In March 1947, President Truman announced his doctrine of containment. In December 1948, the United Nations Technical Assistance Program was established with strong United States support; and in January 1949, Truman delivered his inaugural address containing Point 4, on which technical assistance programs of the future were to be founded:

> Fourth, we must embark on a bold new program for making the benefits of our scientific advances and industrial progress available for the improvement and growth of underdeveloped areas....
>
> I believe that we should make available to peace-loving peoples the benefits of our store of technical knowledge in order to help them realize their aspirations for a better life. And, in cooperation with other nations, we should foster capital investment in areas needing development.
>
> Our aim should be to help the free peoples of the world, through their own efforts, to produce more food, more clothing, more materials for housing, and more mechanical power to lighten their burdens.[6]

The Economic Cooperation Administration, one of the predecessor agencies to AID, was established to administer the new program in Western Europe. The Organization for European Economic Cooperation, the predecessor of today's Organization for Economic Cooperation and Development, was established by European countries in response to the requirements of the Marshall Plan. From this point on there was a growing concern for the transfer of scientific and technical information related to the economic development of friendly countries.

It is interesting to note that an early mission, in 1951, was dispatched by the OEEC to review American documentation techniques. Prophetically the mission asserted: "the successful development of industrial potential must also rely to a great extent on the accessibility of scientific and technical knowledge. As security and economic recovery depend more and more on the ability to step up productivity it becomes increasingly important to ensure that information is freely and, if need be, actively made available."[7]

Dan Lacy reviewed the overseas book program of the United States government in 1954. He found three fundamental sets of problems to which programs had been addressed up to that time:

1. People abroad disliked and mistrusted the United States. This could only be, it was thought, because they were ignorant of this country or misunderstood its aims. Obviously, what was needed was to disseminate information about the United States--in the words of the Smith-Mundt Act, to "present a full and fair picture." This conception of the problem dominated the propaganda effort until 1950.
2. People abroad proved susceptible to Soviet propaganda. This could only be, it was thought, because they failed to penetrate Soviet deceit. The

obvious remedy was to expose the falsehood of the Soviet pretentions--in official language, to wage a "campaign of truth." This concept has dominated subsequent thinking about the information program.

3. People abroad did not produce as efficiently as Americans. This must necessarily be in part at least, it was thought, because they did not know how. The obvious remedy, in the hackneyed phrase, was to export "know-how"--to provide technical knowledge and skills. It was this conception that underlay the Technical Assistance Program.[8]

It is interesting to note that all three sets of problems--propaganda, counter-propaganda, and technical assistance--relate to the Cold War which dominated the thinking of the 1950s and 1960s. The U.S. Information Agency and its libraries were established as instruments of American foreign policy. The defenses of peace were, in the words of the UNESCO charter, to be constructed in the minds of men, and the American library profession and the book publishing industry joined forces with the U.S. Information Agency, AID, and the Department of State in their building.

During the postwar years, AID and its predecessor agencies developed extensive services supportive of technical assistance programs. During the years of European recovery, 1949-55, when the Marshall Plan was at its peak operational status, the ECA, and later the Mutual Security Agency, conducted major programs to aid European countries and restore their productivity. The Technical Cooperation Administration continued the programs initiated during the war in Latin America by the Institute of Inter-American Affairs and conducted operations in Asia and in Africa as well.[9] ECA assured a continuing flow overseas of the best of the U.S. technical books and journals, at a level of $1 million per year. Using the Office of Technical Services as a backstop, the ECA answered technical inquiries of European industrial establishments on products, processes, concepts and techniques at a cost of $200,000 a year. ECA produced special reports transmitting facts, statistics, and analytic information relating to U.S. industrial enterprises. This service averaged over $1 million per year for 2½ years at its peak operation. ECA funded a digest and abstract service of current U.S. industrial practices and techniques, produced technical films and filmstrips relating to industrial processes, management concepts, organized and managed technical exhibits illustrative of new production designs, engineering technologies, and management concepts.

These early years represented the high point of the ECA's efforts to export technical information supportive of development. It is during these years that ECA contracted with the U.S. Book Exchange, which contributed to the stocking of scholarly libraries abroad with low-cost American technical publications.

With the termination of U.S. development assistance for European recovery, U.S. efforts were redirected in support of the developing countries in Asia, Latin America and Africa. The International Cooperation Administration developed a whole series of industrial technical aid services in support of the transfer of know-how helpful to the new or expanding industries in these areas.[10] These services included provision of a technical reference service, publication of a technical digest, an industrial report service, a

training materials service, continuation of support for USBE, for the procurement of technical literature, technical films, and technical exhibits. Subsequently, in 1957, a regional facility was established in Mexico for the translation and publication of Spanish-language versions of the needed technical materials.

The Department of State's library programs were conducted under the authority of the Mutual Educational and Cultural Exchange Act of 1961, whose purpose it was "to increase mutual understanding between the people of the United States and the people of other countries by means of educational and cultural exchange; to strengthen the ties which unite us with other nations by demonstrating the educational and cultural interests, developments, and achievements of the people of the United States and other nations...to promote international cooperation for educational and cultural advancement; and thus to assist in the development of friendly, sympathetic, and peaceful relations between the United States and the other countries of the world."[11]

To advise the USIA and AID on the book and library programs established under this act, the Secretary of State formed a Government Advisory Committee on International Book and Library Programs.[12] This committee, with strong representation from the American book industry, was instrumental in drafting a national policy statement on international book and library activities, which the White House issued in 1966.

This statement, possibly the most sweeping ever made by an American President on the subject, declares that the U.S. government "is prepared, as a major policy, to give full and vigorous support to a coordinated effort of public and private organizations which will make available to the developing countries the book and library resources of the United States which these countries need and desire."[13]

The statement was accompanied by a directive to government agencies for its implementation. The directive itemizes a long list of desirable activities for the agencies to undertake, and directs the Department of State to undertake a coordination role in such a way that government resources will be used with the greatest efficiency and economy.[14]

Underlying the statement were these words from the President's Education Message to Congress, February 2, 1966: "Education lies at the heart of every nation's hopes and purposes. It must be at the heart of our international relations....Books, by definition, are essential to education and to the achievement of literacy. They are also essential to communication and understanding among the peoples of the world. It is through books that people communicate in the most lasting form their beliefs, aspirations, cultural achievements, and scientific and technical knowledge."[15] Two points might be made on this statement: (1) the emphasis was almost entirely on educational and cultural matters, with only incidental reference to science and technology; and (2) while this statement remains a matter of record, to this day it has not been implemented with funds, manpower or further authorizations.

Politically, it is to be expected that the flow of scientific and technical information was of less significance than the provision of educational tools which molded the minds of future generations of individuals in the developing countries. On the one hand Lacy noted: "many of the uses of books ...were simply impossible in terms of the kind of budget there was available ....Particularly was this true in the Technical Assistance Program, where a gigantic world-wide effort at dissemination of technical knowledge involving the annual expenditure of dozens of millions of dollars had paradoxically made practically no provision whatever for the use of books as vehicles for that dissemination."[16]

On the other hand, at the request of AID, the Department of Journalism, American University, organized an Airlie House Conference on the Role of Books in Human Development, Septermber 1964. The conference concerned itself with the use of books in the educational systems of developing societies. Only after planning was well underway was it realized that science teaching materials could not be treated adequately within the framework of the other committee assignments. Hence, as something of an afterthought, the conference belatedly established a committee on textbooks for the undergraduate teaching of science.[17]

In September 1962, the administrator of AID issued a statem nt on the agency's book program policy:

> The Agency for International Development recognizes that: a) Books are one of the major factors in building the human resources required for political, economic, and social development of a nation. They are a tool for stimulating leadership and the general public in thinking about political, economic, and social issues. They offer information which is vital for a balanced understanding of social, political, and economic processes with which an emerging nation has to deal, and they are a record of action taken in dealing with social and economic problems. They serve as a medium for the transfer of knowledge and know-how in the education and training process. b) In nearly all underdeveloped countries there exists an extreme shortage of books in all fields of knowledge. c) A.I.D. has a basic responsibility to give the people in the underdeveloped countries access to the intellectual resources and technical skills of the Western World, as reflected in technical, text, and reference books. d) These considerations dictate an A.I.D. policy of which the following points are basic elements:
>
> The fact that books and publications are significant tools in economic and social development should be reflected in appropriate form and on adequate scale in the A.I.D. program.
>
> The former restrictive concept which limited activities regarding books to project-related operations is explicitly rejected.[18]

In what is perhaps the most comprehensive published review of AID book programs, the agency reaffirmed this policy, and gave a number of examples of program activities it had undertaken in a variety of fields.[19] The shift from project-related operations to media-related support constituted a major policy change destined to improve the underutilization of books and journals in book and library programs, which Lacy described earlier. Among other activities, it resulted in the support of the ALA International Relations Office from 1967-1972.[20] The media-related book and library programs were concentrated in the AID Office of Education and Human Resources, where they were associated with long-range programs for the strengthening of educational institutions, including library development and the development of indigenous publishing industries. While other AID programs (e.g., in the Office of Health and the Office of Science and Technology) have engaged in specific support activities, it is the Office of Education and Human Resources which has had the primary concern for the strengthening of institutional infrastructure for later economic development.

This office has produced a useful bibliography of studies related to book, textbook, and library development. Only a handful of these studies, however, is concerned with the transfer of information for technological development or industrial purposes.[21]

During the long history of AID and its predecessor agencies a number of projects relating to technical information transfer to developing countries have been attempted. Possibly one of the earliest, and certainly one of the better known to the library community, was AID's support of the foreign operations of the U.S. Book Exchange, Inc., so unfortunately interrupted by a labor dispute. As Orne has pointed out, during the first six years of assistance from the International Cooperation Agency/Agency for International Development (1954-1960), the USBE shipped 2,525,000 books and journal items to over 1,800 foreign libraries at a total cost of about $1.5 million.[22] Since USBE's holdings are strong in scientific, technical, and medical publications, this accomplishment represents possibly one of the largest traditional forms of technical information transfer to developing countries yet made by the United States.

Representative of other science and technology projects, AID contracted with the Office of Technical Services (now the National Technical Information Service), Department of Commerce, for the provision of an "on-demand" technical reference service for AID missions in the field. This service was roughly comparable to those now offered by the Organization for Economic Cooperation and Development to developing countries from Paris, and by the United Nations Industrial Development Organization from Vienna. Recently, a new cooperative publishing venture has been undertaken between AID and NTIS. Entitled Application of Modern Technologies to International Development, this publication consists of abstracts of selected technical reports deemed to be of usefulness in developing countries.[23]

Another science-related project was undertaken by the National Academy of Sciences on behalf of AID. From 1963 to 1968 the academy operated a science book procurement program on behalf of selected recipient institutions in developing countries. While this program had its administrative frustrations, it was not without a modest success in assisting other countries to

acquire the literature they needed.[24]

The projects discussed so far all relate to classic techniques for the dissemination of technical information. They are founded on the assumption that a country committed to a program of economic development needs an infrastructure of strong educational institutions, improved information resources, and skilled human resources. The UNESCO documentation centers, as well as American programs for the support of libraries and specialized information centers in developing countries, have been built on this philosophy.

It has proved difficult to demonstrate the specific contribution of such book and library programs to the transfer of technology necessary to industrialization; at best, such programs are a long-range investment in the literacy and education of a generation which will run the country's affairs at some future time.

To recapitulate, the humanitarian interests of the library profession, which found expression in the American Book Center and the various book and journal donation programs which followed World War II, were superseded by government-sponsored programs which featured the role of books and libraries in the postwar struggle for men's minds--the Cold War. In the ensuing years, the use of printed information for the long-term purposes of education and cultural advancement received more attention in USIA and AID programs than has the use of technical information which might be of direct assistance to industrialization and economic development.

Critics have been outspoken in their assertions that the classic programs of foreign assistance have outlived their usefulness. John Galbraith, for example, has suggested that in dealing with the Third World we should by now have learned four lessons: (1) that the Marshall Plan "syndrome" has turned out to be largely irrelevant and unworkable in the poor countries which lack Europe's pre-existing organizational, administrative, and technical capabilities; (2) that in the poor countries of the world, the fact that they are poor and rural has much greater meaning than do the concepts of communism and capitalism; (3) that the bureaucracies which we have created for the administration of foreign aid programs are grossly ineffective; and (4) that we have created an overseas bureaucracy, both civilian and military, which we cannot control.[25]

Senator Frank Church has been even more critical of the failure of our policy of using foreign aid to contain communism. "Even if the premise of a unified aggressive 'international communism' had been sound," said Church, "the strategy for countering it with foreign aid was not. Experience has shown that, although military assistance can be a potent factor in counter-insurgency, it is by no means a reliable one, while American economic support has almost no influence whatever on whether a country 'goes Communist,' as Cuba and Chile have shown. This is not for lack of skill or technical know-how on the part of those who administer the AID program, but it is because of the irrelevance of the instrument to the objective."[26]

Whatever may be the immediate future of foreign aid appropriations legislation in the Congress, there can be no doubt that there is a growing belief that the philosophy of the Marshall Plan, which combined military aid with technical assistance, is outmoded, and that U.S. national programs for technical assistance to developing countries must be replanned.

A second major change has to do with a revolution in our thinking about technology. We have learned that it is imperative to be able to make informed choices in the future about those elements of technology which we may selectively exploit without further harm to the quality of life, or even to the survival of the earth as we know it.

Our new approach to the utilization of technology has two aspects. The first of these is technology assessment, which has been defined succinctly by the National Academy of Engineering to comprise "the sociotechnical research that discloses the benefits and risks to society emanating from alternative courses in the development of scientific and technological opportunities."[27] The second of these is technology transfer, defined as the process through which a technological advance is implanted in a new socio-cultural situation.

Our enormous concern over technology assessment is in large measure a tribute to what one enlightened legislator, former Congressman Emilio Daddario of Connecticut, has accomplished. Daddario's subcommittee on Science, Research and Development of the House Committee on Science and Astronautics encouraged both the National Academy of Science and the National Academy of Engineering to undertake studies of the processes of technology assessment.[28] He further commissioned the National Academy of Public Administration to outline a technology assessment system for the Executive Branch,[29] and the Library of Congress Legislative Reference Service to do an inquiry in depth on Technical Information for Congress.[30] Finally, he authored the bill proposing an Office of Technology Assessment within the legislative branch, and held a series of highly informative hearings.

However important this concept of technology assessment may be for the future science policy of the United States, and indeed for the development of information systems to support decision-making both by the Executive and the Congress in this enormously complex field, I am concerned here only with the implications of technology assessment for the developing countries.

In proposing a possible framework for technology assessment within the structure of the United Nations, Dennis Livingston has pointed out that "it is possible that some of [the less-developed countries] will want technical assistance in the establishment of assessment bodies within their governmental structures, perhaps for the evaluation of local environmental and social consequences of technology imported by foreign firms; or, they may wish the postulated international assessment agency to undertake such a study. There is also the fact that many of the technological developments originating within the industrialized nations have deep implications for the less developed areas, both generally, as in the migration of talented individuals from their homelands...and specifically, as in the manufacture of synthetic goods that may rival natural products on which countries depend for international exchange.[31] As the techniques for technology assessment become developed,

they are sure to have an effect on the ability of a less-developed country to select that area of technology of greatest economic and social promise to the particular country.

I have discussed the topic of technology assessment first, since it accentuates the importance of selection by the developing countries as they attempt higher levels of industrialization. It becomes obvious that they must improve techniques for choosing specific technologies for transfer from the more highly developed areas. Information resources and services have a role to play, as yet inadequately defined, in assisting such decision-making. But more importantly, before the United States can effectively support a country's economic growth with technical information resources and services, both the donor and the recipient countries need to pinpoint their objectives. There is still a great deal to learn about the processes by which a technology developed in one country flourishes when transplanted to an alien culture. For that matter, there is much to learn about establishing a viable system for technology transfer in the United States, as the history of the State Technical Services Program of the Department of Commerce indicates.

Nonetheless, there is some domestic experience on which to build. The Department of Agriculture has had its time-honored Agricultural Extension Service; the AEC its Industrial Cooperation Program; NASA its Technology Utilization Program; and, of course, there is the growing number of technology application centers.[32]

In a recent review of the literature of technology transfer, Charles F. Douds has traced its evolution through the three stages of global speculation, case reports, and controlled studies permitting generalization.[33]

NASA has supported a study of the feasibility of using space-generated technology for development purposes in Brazil. In conducting this study, Arthur D. Little Co. matched a list of needs against a list of NASA descriptors. The study indentified some forty plausible matches of needs and relevant technology, but sensibly pointed out that such matching represented only a starting point. At every point in the transfer process, barriers to change exist, the study reports, which impede and in many cases prevent implementation. The study further concludes:

> Technology transfer differs in its requirement from data acquisition, information retrieval, and information interchange. For example, transfer requires people in the disseminating culture and in the recipient culture who both comprehend the technology and perceive its secondary application as a viable part of the recipient culture. Moreover, technology transfer requires the participation not only of economists, scientists and engineers, but also entrepreneurs, innovators, information specialists, and social scientists. Transfer also requires--at the very least--acquiescence by the possessor of the technology. Still more, it requires a will to accept on the part of the recipient.[34]

It should be obvious that the imperfectly understood mechnaisms for technology transfer to the developing countries represent unsolved problems of social engineering. It should be equally obvious that the transfer of technical information, while constituting but one of the functions to be provided for, is nonetheless fundamental to the process.

Experience has proved the traditional shotgun approach of institution building a slow and expensive process. The building up of library resources and of technical documentation centers, while important in the long run to U.S. economic potential, is not in itself enough. Provision must be made for the support in depth of specific technology transfer projects of direct benefit to the economy. Librarians and information scientists alike are faced with a challenge of considerable complexity. How can they best organize their technical information resources to make their maximum contribution to the interdisciplinary group concerned with the technology transfer process?

The Office of Science and Technology, AID, recently asked the NAS for recommendations on appropriate activities involving the transfer of scientific and technical information to developing countries. The academy's report, Scientific and Technical Information for Developing Countries, states a priority need to strengthen the institutional and manpower infrastructures in developing countries so that they may effectively utilize the information being transmitted to them. This would be a task to be shared by AID and the recipient country, with the latter establishing a governmental focus for this activity.[35]

In line with the recently published OECD Study Group recommendations, "Information for a Changing Society,"[36] the NAS study recommends that AID stimulate the participating countries to formulate national policies regarding scientific and technical information. It further recommends that information activities should constitute a significant component of the problem-oriented assistance programs administered by AID. This last recommendation complements the first: AID is encouraged to supplement the efforts of developing countries to create an infrastructure of manpower and information materials on the one hand, and on the other to build upon specific information transfer projects which have gained the cooperative interest of the developing country.

It must be admitted that these approaches, as well as others attempted, are experimental. To educate across geographic barriers, across linguistic and cultural gaps, and in the absence of formal educational institutions presents many difficulties--and it is an educational process which is at stake, since it is intended to modify behavior patterns. The scientific and technical information resources and services developed in the United States have been machined for utilization in our culture, with all its complexity and sophistication. Without doubt the technical knowledge we have created has high utility in assisting the developing countries to reach higher levels of industrialization and economic independence. The problem of insuring this is not a technical one; the questions here are those of organization, management, human resources and incentives.

As the President's Task Force on Science Policy recently reported in Science and Technology: Tools for Progress: "The question of international technology transfer--the delivery and application of scientific and technological knowledge, methods, and techniques from one nation to another--is one which the United States should give very searching consideration in its formulation of a more effective science policy."[37] I suggest that it is one of the frontiers of information science and librarianship actively to couple the information resources, systems, and expertize so far developed so that they can effectively support the transfer of technologies to the countries in need of them for their economic and social stability, and independence.

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ACRONYMS

AAAS	American Association for the Advancement of Science
AEC	Atomic Energy Commission
AGARD	Advisory Group for Aerospace Research and Development
AGRIS	Agricultural Research Information Service
AID	Agency for International Development
CADO	Combined Air Documents Office
CAS	Chemical Abstracts Service
CMEA	Council for Mutual Economic Assistance
COSATI	Committee on Scientific and Technical Information
DIMDI	Deutscher Institut fur Medizinsche Dokumentation und Information
DOD	Department of Defense
ECA	Economic Cooperation Administration
EEC	Commission of the European Communities

ESRO	European Space Research Organization
EURATOM	European Atomic Energy Community
FACSI	Federal Advisory Committee on Scientific Information
FAO	Food and Agricultural Organization
FCST	Federal Council for Science and Technology
FID	International Federation for Documentation
HEW	Health, Education and Welfare
ICSI	International Conference on Scientific Information
ICSU	International Council for Scientific Unions
INIS	International Nuclear Information System
INSERM	Institut National de la Santé et Récherche Médicale
IPG	Information Policy Group
ISI	Institute for Scientific Information
LC	Library of Congress
MEDLARS	Medical Literature Analysis and Retrieval System
NAS	National Academy of Sciences
NASA	National Aeronautics and Space Administration
NGO	Nongovernmental Organizations
NLM	National Library of Medicine
NSF	National Science Foundation
NTIS	National Technical Information Service
OAS	Organization of American States
OECD	Organization for Economic Cooperation and Development
OEEC	Organization for European Economic Cooperation
OSI	Office of Strategic Information
PSAC	President's Science Advisory Committee
RECON	Remote Console System
SDIM	System of Documentation and Information for Metallurgy
SLA	Special Libraries Association
UNESCO	United Nations Educational, Social and Cultural Organization
UNIDO	United Nations Industrial Development Organization
USBE	United States Book Exchange
USIA	United States Information Agency
VINITI	All Union Institute of Scientific and Technical Information
WHO	World Health Organization

VITA

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